WHAT IS CLAIMED IS

1. A microfluidic device formed from a substrate, said device comprising a plurality of units in said substrate, each unit comprising 4 assay units, where the 4 assay units have 4-fold symmetry, said units further characterized by:

a common reagent source for said 4 assay units;

two waste sources for each assay unit, each waste source shared by two assay units;

each assay unit having a delivery channel and an assay channel crossing at a cross-intersection for injecting an assay mixture from said delivery channel into said assay channel; and

a plurality of reservoirs for providing buffer, receiving waste and, as required, providing additional reagents.

2. A microfluidic device according to Claim 1, wherein said assay unit comprises 2 assay subunits.

3. A microfluidic device according to Claim 1, wherein said common reagent source comprises a PCR reactor, a bead reservoir and a buffer reservoir.

4. A microfluidic device according to Claim 1, wherein said substrate is plastic.

5. A microfluidic device according to Claim 1, having at least about 96 assay units.

6. A microfluidic device according to Claim 5, wherein said device has a row of half-units of two assay units each along two edges of said substrate.

7. A microfluidic device according to Claim 1, wherein said cross-intersection is a double-T intersection.

8. A microfluidic device formed from a substrate, said device comprising a plurality of units in said substrate, each unit comprising 8 assay units, where the 8 assay units have 8-fold symmetry, said units further characterized by:

a common reagent source for said 8 assay units;

two waste sources for each assay unit, each waste source shared by two assay units;

each assay unit having a delivery channel and an assay channel crossing at a cross-intersection for injecting an assay mixture from said delivery channel into said assay channel;

a plurality of reservoirs for providing buffer, receiving waste and, as required, providing additional reagents;

electrodes associated with a plurality of said reservoirs operatively connected to a computer.

9. A microfluidic device according to Claim 8, wherein said delivery channel and said assay channel differ in at least a portion of said channels in cross-section.

10. A microfluidic device according to Claim 8, wherein said assay units of said microfluidic device are spatially organized to conform with a 96 or 384 microtiter well plate.

11. A microfluidic device according to Claim 8, wherein said cross-section intersection is a double-T intersection.

12. In a method for performing a multiplexed operation in a microfluidic device, the improvement which comprises using a microfluidic device according to Claim 1.

13. A method according to Claim 12, including the additional steps of:

introducing a detectable agent at a site of introduction, which site is a component source or a channel downstream from said component source;

detecting the presence of said detectable agent downstream from said site of introduction; and

determining the elapsed time of travel from said site of introduction to said detection site as indicative of the velocity/flow rate in said channel.

14. A method according to Claim 12, wherein said agent is a thermal pulse, fluorophore or bead.

15. A method according to Claim 12, wherein said site of introduction is a reagent source.